Asian Social Science; Vol. 13, No. 1; 2017
ISSN 1911-2017 E-ISSN 1911-2025
Published by Canadian Center of Science and Education

Natural Disaster Mitigation through Integrated Social Learning Science in Primary School

Setyo Eko Atmojo[1], Deri Anggraini[1] & Taufik Muhtarom[1]

[1] PGRI University of Yogyakarta, Sonosewu, Yogyakarta, Indonesia

Correspondence: Setyo Eko Atmojo, PGRI University of Yogyakarta, IKIP PGRI Street 117, Sonosewu, Yogyakarta, Indonesia. Tel: 6285225998365. E-mail: setyoekoatmojo@yahoo.co.id

Received: November 22, 2016 Accepted: December 1, 2016 Online Published: December 20, 2016

doi:10.5539/ass.v13n1p161 URL: http://dx.doi.org/10.5539/ass.v13n1p161

Abstract

This research aims to develop a learning model in disaster volcanic eruptions, floods and earthquakes integrated in social science subjects and in elementary school level. This learning model includes five features, namely: (1) the model syllabus and lesson plans, (2) the theme and subthemes, (3) teaching methods, (4) materials / textbooks and CDs about the disaster of nature, and (5) techniques and types assessment of student learning outcomes. Improving the knowledge and skills of teachers and students about the concepts, principles and practice self-rescue if the occurrence of natural disasters. This study is a research and development (R & D) in elementary school. This type of data consists of qualitative and quantitative data. Exploratory data analysis results based disaster mitigation model of learning is conducted qualitatively by descriptive percentage. Analysis of empirical test data using descriptive statistics percentages. Data were analyzed with the results of the implementation of parametric statistical tests, descriptive of the samples using a t-test. Research shows that learning device development results declared effective because it proved able to increase disaster mitigation skills of students, student learning, and the comfortable to be applied at primary school level.

Keywords: disaster mitigation, disaster learning, integrated social science

1. Introduction

In geological, climatological and geographical, Indonesia is prone to disaster. There is a significant increase in natural disasters in Indonesia compared by the previous year. This disaster makes a wide variety of losses and changes the environment. The IPCC concludes that regional changes in temperature have an effect on natural environment (Kurniawan, 2009). Global warming may cause a tropical cyclone and increase bad weather (Goebbert & Leslie, 2010). Indonesia is one of countries which is located in the danger zone of disaster. The geographical position of the Indonesian archipelago which is very unique cause Indonesia include in areas that are prone to disasters. The Indonesian archipelago including the pacific ring of fire (a row of volcanoes Pacific), also located at the confluence of three tectonic plates of the world and affected three movements, which are: the movement Sunda system in the western part, the movement system of suburbs of East Asia, and Australia circum movement. These factors led Indonesia to be prone to natural disasters such as volcanic eruptions, earthquakes and volcanic eruptions (Oktarina, 2008).

Merapi Mount is one of the volcanoes in Indonesia which has a great potential danger when the volcano erupted. Merapi eruptions followed by big losses. Losses caused by the eruption of Mount Merapi is very diverse, ranging from material losses to victims, the harm caused by the eruption of Mount Merapi is very diverse, ranging from the loss of material to the victims. Based on data from the National Agency for Disaster Management (BNPB) in 2011, when Merapi erupted it causes many death victims, as many as 374 victims and the number of refusse as many as 279.702 inhabitants while the loss after the eruption of cold lava in Magelang District led to 2,836 residents displaced and 286 houses were damaged and washed away by the brunt of lava cold. In addition, the Merapi eruptions also cause the activities of people around the slopes of Mount Merapi became paralyzed. Mount Merapi is located on the border of two provinces, Central Java and D.I. Yogyakarta. Magelang is an area which located on Merapi eruption danger zone.

The eruption of Mount Merapi caused deep concern about the disaster that befell the people in the district of Magelang, Sleman and surrounding areas. Seeing the losses caused the eruption of Mount Merapi is not small, it is necessary to mitigate the eruption of Mount Merapi to reduce such losses. The number of disaster-prone areas

in Indonesia and the increased importance of disaster risk reduction efforts is a strong foundation for Indonesia to jointly undertake disaster risk reduction efforts by integrated and focused way. As educators, the research team will contribute in increasing public understanding of the disaster, public understanding will focused on understanding the catastrophic volcanic eruptions, floods, and earthquakes through integrated social science learning in subjects materials in primary school. The model which will be developed is a learning model integrated social science disaster. Teacher transfers information and knowledge to the students and the civilazion. Teachers as one component of society have a strategic role to prepare young people from an early age to better understand about natural disasters. The concept of this natural disaster will be easily understood if it explained by using an integrated learning model of social science, such as the integration between science and society. Learning model is packaged and integrated into the school curriculum and implemented at school level basic because of several reason: (1) the results of education are durable and long-term, (2) reaching populations large enough for the nation's future, and (3) it is very appropriate time to seed values and moral social to students.

The problem which studied in this research is: "How does learning model integrated disaster social science in primary school?" Of these problem can be formulated several research questions as followed: (a). What is themes and sub-themes which can be developed in the curriculum integration of disaster volcanic eruptions, floods and earthquakes?, (b). How to develop a syllabus and lesson plan on disaster learning model integrated social science in primary school? (C) What forms of teaching materials on disaster learning model integrated social science in primary school? (D) What forms and assessment techniques that can be used to determine the success of social learning model integrated disaster science in primary school? (E) How appropriate the learning model which developed with empirical data in the field?

The main objective of this study was to develop a mitigation model of natural disasters through an integrated social science disaster learning in primary schools. The specific objective is: a. Develop learning model disaster volcanic eruptions, floods and earthquakes is integrated in the subjects of science and social. This learning model includes five features, that are: (1) the model syllabus and lesson plans, (2) the theme and subthemes, (3) teaching methods, (4) materials / textbooks and CDs about the disaster of nature, and (5) techniques and types assessment of student learning outcomes. b. Improving the knowledge and skills of teachers and students about the concepts, principles and practice self-rescue in case of natural disasters. c. Increase collegiality between lecturers and teachers as well as teachers to teachers in teaching material.

Every citizen has an equal right in education services, including students in disaster-prone areas. Providing services for student learning in areas prone to flooding would have been different with the students in a safe area. In order to undertake the management of disaster mitigation and appropriately, students in disaster-prone areas need to get learning about the natural disaster. One of learning model that can be developed is to integrate disaster material into lessons. Thus, the core curriculum does not need to be changed, do not need to create new subjects, but simply by integrating natural disaster material into social and science subjects.

Society needs to increase its capacity as residents living in disaster prone areas, to know and understand the level of potential disasters, shape and great strength of disasters that might occur. Disaster mitigation through learning, can be used to educate public to face natural disasters in the future. These activities can be started with the provision of information on potential natural disasters precise, accurate of the whole apparatus and related disciplines. By knowing these things, people are mentally better prepared to cope with disasters.

2. Methods

2.1 Design Research

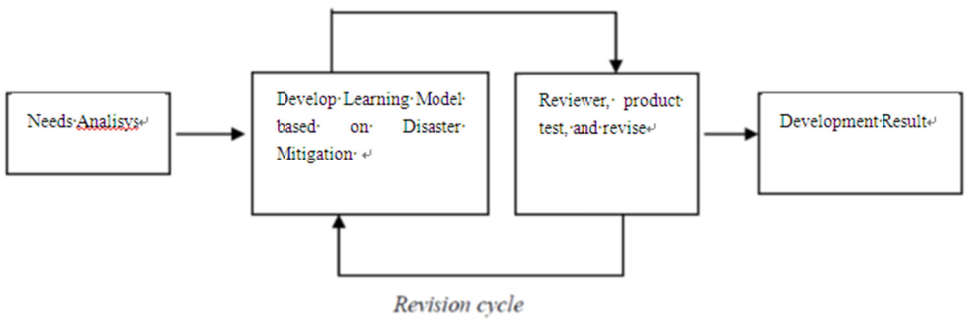

Figure 1. Development Learning Model-Based Disaster Mitigation. (Rusilowati et al., 2012)

This study is a research and development (R & D) carried out in collaboration with the teachers in primary schools. The study design is shown in Figure 1.

2.2 Stage Research

The research was conducted in three stages, that are: (1) exploration theoretically and reviewing from experts and stake holder of the five features instructional model disaster social sciences integrated, such as: the syllabus and lesson plans, themes and subthemes, learning methods, techniques and types of assessment across cultures, and textbooks. (2) empirical test, which aims to validate empirically fifth feature natural disaster learning model that integrated in social science learning. (3) The implementation phase which aims to implement the model, to determine the effectiveness of the model, and obtain the learning model that has been tested.

2.3 The Test Product

Experiments intended to determine readability teaching materials, learning scenarios (in lesson plans), and the characteristics of the evaluation tool and question item. In addition, to determine the amount of time required to complete each learning theme and tests which are planned. Thus, the model teacher and tests maker can estimate the amount of time and number of the corresponding question.

1. Design of Experiments

The product development is carried out in two stages, that are the individual test and field test. Individual Test: first by experts and studies teachers. Both apply to some teachers and students (5-10 people). Field test was conducted in a model school (1st class). Design trialling draft model can be seen in Figure 2.

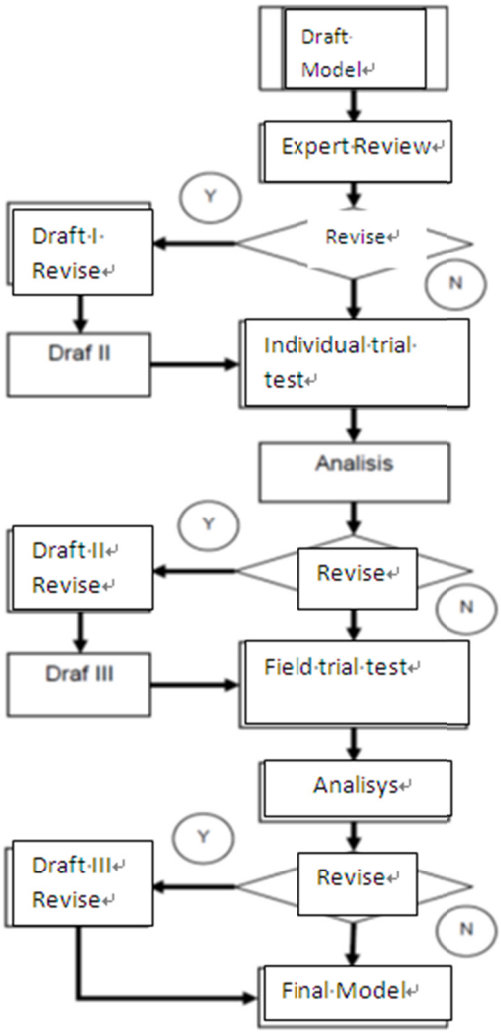

Figure 2. Trial Design

2. Subject Tests

Based on consideration of geographical and historical disaster, Yogyakarta is declared as an empirical test location about the learning model in volcano erupts disaster, floods and earthquakes. Individual test subjects are experts and practitioners (3 teachers), while the subject of a limited field trials are few teachers and primary students. Subject field trials are elementary school students. The technique of taking the subject field trials by purposive and cluster sampling. The number of schools being used as a test subject and implementation are four schools, two primary school in disaster-prone area of volcanoes and two primary schools in region prone to earthquakes and volcanic eruptions in Yogyakarta.

3. Data Type

This data type obtained from the trial test product which there are two kinds: qualitative and quantitative data. Qualitative data got from expert response, and quantitative data got from student respond (score) tested.

4. Instruments Data Collectors

Instruments that used in this test are observation sheets, questionnaires and tests. Observation sheet to determine the enforceability of learning model, the activities of teachers and students. The questionnaire addressed to teachers to determine the suitability of materials with students development, learning scenarios readibility and conformance tests with the purpose of learning. The questionnaire also addressed to students, which purpose to know about the readability and instructional materials. Test developed form is multiple choice, with four answer choices, and descriptions.

5. Data Analysis Techniques

Data analysis techniques used to answer the research problem. Data analysis exploratory results of learning model based disaster mitigation is done qualitatively with the help of descriptive percentage. The analysis of the empirical test data using descriptive statistics percentages. Data of implementation were analyzed by parametric statistical tests, descriptive of the samples using a t-test.

$t = (X - \mu 0)/(s/\sqrt{n})$

X is the average score, μ0 is hypothesized value, s is standard deviation, and n is the number of sample. Learning outcome is determined by the formula Gain normalized.

$$G = \frac{skor\ posttest - skor\ pretest}{100\% - skor\ preiest}$$

NB: pretest and posttest scores in percentages.

6. Product Quality Standards Research

There are five features of the development model of mitigation of natural disasters resulting from this research. Quality standards for each feature is determined as follows:

1) The results of an syllabi and lesson plans assessment are minimum good in both categories

2) Themes and sub-themes are minimum good in both categories

3) Teaching materials on disaster mitigation and CD-based learning has a readability level easily understood (legibility coefficient> 0.3), and easy to use

4) evaluation tool should be reliable (the price of $r \geq 0.7$), valid, has a medium difficulty level (with the index level of difficulty from 0.3 to 0.7), and different power good (with a different power index ≥ 0.3). In addition, the results of the implementation of the model is expected to increase students' understanding of the material of natural disaster. Standards of learning achievement of the objectives set out as follows: the acquisition of each individual score ≥ 65 and the percentage of classical completeness is ≥ 85% of students have achieved a score of ≥65.

3. Results

The implementation phase of learning tools that have been developed can be described as follows:

Disaster mitigation in learning activities students are expected to do or have disaster mitigation skills, because that learning model is packed learning through observation, discussion, presentation and simulated natural disaster. Disaster mitigation skills of observation results can be seen in Table 1.

Table 1. Students Disaster Mitigation Skills

No	Aspects of disaster mitigation skills	Frequency students who making aspect Disaster Mitigation Skills	
		Class	
		experiment 1	experiment 2
1	Immediately out of the building in case of earthquake	24	24
2	Protect head when they ran out of the building	15	17
3	If the shelter under a table did not get out	18	22
4	Choosing the outdoors, avoid electric poles, billboards, and did not stop at the bridge	21	24
5	Ran away from the mountain and hot clouds	20	20
6	Protect eyes with sunglasses from volcanic ash	18	22
7	Ran to the emergency room / location that is safe from the eruption	19	20
8	Using a mask when leave home	23	24
9	Stay away from the beach when there is a warning of tsunami	24	24
10	Invite friends and other people around to stay away so as not many victims	10	26
11	Prioritizing own soul and the family rather than possessions	23	24
12	Helping family, friends and anyone who is a victim of the disaster ends	16	17

The results of the implementation of learning tools on disaster mitigation impact on improving student learning outcomes that can be seen in Table 2.

Table 2. Calculation Results Improved Learning Outcomes

Class	Pre Test	Post Test	Gain	N gain	criteria
experiment 1	52,56	71,74	47,44	0,40	Medium
experiment 2	54,76	74,03	45,24	0,43	Medium
control 1	49,80	62,00	50,20	0,24	Lower
control 2	51,50	64,40	48,50	0,26	Lower

To determine whether a learning tool in disaster mitigation appropriate to be implemented in the learning, an accuracy of the learning questionnaire distributed to the students and direct interviews teachers in schools. Results calculation of accuracy questionnaire is given to the students' learning can be seen in Table 3.

Table 3. Results of the questionnaire calculation accuracy learning

No	Score	Criteria	Experiment 1		Experiment 2	
			$\sum$ student	%	$\sum$ student	%
1	17-20	Very precise	11	32,35	12	35,30
2	13-16	precise	18	52,95	20	58,82
3	9-12	Less precise	5	14,70	2	5,88
4	5-8	Not exactly	0	0	0	0
		Total	34	100	34	100

Based on these calculations, it means that the device is appropriately applied to disaster mitigation learning in class because > 80% of students give positive response to the disaster learning integrated social science.

Meanwhile the results of interviews researchers to classroom teachers in school are learning devices accordance with the competence (of interest) to be achieved and the students' characteristics, coherent, easy to applied in learning, practice to use, and can increase the skills of disaster mitigation and improve student learning outcomes.

Teachers did not face significant obstacles when they implemented learning model in classroom, obstacles arise precisely from students because they are not familiar with this kind of learning. Constraints of students only occurs at the beginning after that learning activities teachers reveal students who originally confused already can follow the lesson well, so that learning becomes interesting and be active learning for student. In addition to disaster mitigation skills learned in the implementation of the results, this study also conducted observation of student activity. Results of activity observation of students in disaster mitigation can be seen in Table 4.

Table 4. Calculation Results Percentage of Each Activities Aspect

No	Activities Aspect	Experiment 1		Experiment 2	
		$\sum$ student	%	$\sum$ *student*	%
1	Listen to the ideas / opinions of the group.	24	70,59	23	67,65
2	Providing ideas / opinions to the group	23	67,65	25	73,53
3	Ask the group members if there are problems that are not understood.	14	41,18	17	50,00
4	Responding to questions from other groups.	18	52,94	21	61,76
5	Leave a question in accordance with the results of another group discussions presentations	13	38,24	17	50,00
6	Involved at the time of fixing the results presentation.	34	100	34	100
7	Responding to questions from the teacher.	22	64,71	18	52,94
8	Writing teacher's explanations	34	100	34	100
9	Listen to the teacher's explanations	34	100	34	100
10	Reading books, worksheets or relevant to the lesson	26	76,47	25	73,53

4. Discussion

In developing these learning tools, researchers are using the Four D model which consisting of four stages: defending, designing, developing (develop), and spreading (disseminate) is not done. Phase disseminate not be done because the development model used in developing learning device has been modified to the activities contained within each step and phase Four-D and not just a change of four phases into three phases but also characterize the process and the distinctiveness of activity in research steps conducted by researchers (Rohmad 2011, Kunreuther, 2006, Peguero, 2006).

The results showed an increase in disaster mitigation skills due to the learning model disaster mitigation give flexibility to students to perform a variety of learning activities, for example allowing them to train themselves to draw conclusions. Giving information about the activities to be carried out also encourages students to undertake disaster mitigation skills in learning. (Balakirsky et al., 2007; Ohgai et al., 2005), suggest ways to help a person in order to carry out aspects of disaster mitigation skills well, one of them is to let them train themselves draw conclusions based on clues or indirect evidence.

Student activities during the learning disaster mitigation showed an increase. The type of disaster mitigation skills that can be performed by students at the primary school does not spread as well as adults because of the limitations of their mindset (Comfort, Oh, Ertan, & Scheinert, 2010). In simple skills disaster mitigation to be possessed by students at least consists of: the skill to avoid disaster, to protect themselves and help others (Burby, 2006). It is believed that all three mitigation skills using simple language and procedures of the appropriate mindset of primary school students.

Disaster mitigation learning has covered a third of the disaster mitigation skills. In the process of learning integrated social science students learn by observing and doing practical disaster simulation process directly, with little guidance from the teacher the students can understand the way to escape from the disaster. By doing practical disaster mitigation students will work according to the steps contained in practical instructions that had

been developed at the previous meeting. Observation, discussion, and then present the results in front of the class after the students report the results of observation are aspects of disaster mitigation skills aspect which executed entirely by students with both then after learning of students will have the skills of disaster mitigation is better than before (Imamura et al., 2012; Yamazaki et al., 2010).

Implementation of disaster mitigation learning device also affects students learning outcomes. The results showed differences in learning outcomes among students who had learning with disaster mitigation learning and students who received conventional learning. Where students got a lesson with mitigation of disaster (experimental group) had results higher learning than students who received conventional learning (control group), this is due to learning by using disaster mitigation students more interested, enthusiastic and students feel learning disaster mitigation is more fun than conventional learning. Besides, also in the conventional learning teacher holds a dominant role while students tend to be passive.

The improving student learning outcomes is due to the involvement of students during the learning process. This is in accordance with the opinion of Darsono (2004) which states that one of the principles of learning is experiencing its own, meaning that students who perform with his own will obtain optimal learning results. In learning to use a learning tool in disaster mitigation students actively involved in learning and so has a better understanding for students than who studied conventionally. Students who are active in the learning activities will have better understanding and learning outcomes than students who only listen to the teacher's explanation and passive during learning activities (Yamazaki & Zavala, 2013; Galindo & Batta, 2013).

Based on observations known that the activity of students in learning activities positively impact in student learning outcomes, so the higher the activity of students the higher learning outcomes achieved by students. Occurrence of increasing disaster mitigation skills of students, students cognitive learning outcomes and learning activities of students in disaster mitigation indicate that the learning tools that have been developed appropriate applied in the classroom.

5. Conclusion

1. The device in the form of learning model syllabus, lesson plan, teaching materials, worksheets, LDS (student discussion worksheet) and evaluation tool developed according to the learning characteristics of disaster mitigation. The first phase of defending is literature study and survey of the potential for disaster in the student residence. The second phase includes the selection of the design and planning approach to product development. The third stage is the development of learning tools disaster mitigation, validation by the team, revision, limited testing and extensive trials in Ngaglik elementary school and Parangtritis elementary school.

2. The development of learning outcomes is declared effective because it proved able to increase disaster mitigation skills of students, student learning outcomes, and the apropiate to be applied at school.

*A*cknowledgements

We would first like to thank our advisor Prof. Buchory MS, M.Pd at PGRI University of Yogyakarta. We would also like to thank the Indonesian Ministry of High Education who were fund this research.

Finally, we must express our very profound gratitude to my partner in PGRI University of Yogyakarta for providing me with unfailing support and continuous encouragement through the process of researching and writing this report. This accomplishment would not have been possible without them. Thank you.

References

Aysan, Y., & Davis, I. (2013). *Disasters and the Small Dwelling: Perspectives for the UN IDNDR.* Routledge.

Balakirsky, S., Carpin, S., Kleiner, A., Lewis, M., Visser, A., Wang, J., & Ziparo, V. A. (2007). Towards heterogeneous robot teams for disaster mitigation: Results and performance metrics from the RoboCup rescue. *Journal of Field Robotics, 24*(11-12), 943-967. https://doi.org/10.1002/rob.20212

Burby, R. J. (2006). Hurricane Katrina and the paradoxes of government disaster policy: Bringing about wise governmental decisions for hazardous areas. *The Annals of the American Academy of Political and Social Science, 604*(1), 171-191. https://doi.org/10.1177/0002716205284676

Comfort, L. K., Boin, A., & Demchak, C. C. (Eds.). (2010). *Designing resilience: Preparing for extreme events.* University of Pittsburgh Pre.

Comfort, L. K., Oh, N., Ertan, G., & Scheinert, S. (2010). Designing adaptive systems for disaster mitigation and response. *Designing resilience: Preparing for the extreme events,* 39-40.

Enarson, E., & Chakrabarti, P. D. (Eds.). (2009). *Women, gender and disaster: global issues and initiatives.*

SAGE Publications India.

French Wetmore and Gil Jamieson (Source: http://www.colorado.edu/) [accessed 14-10-2015].

Galindo, G., & Batta, R. (2013). Review of recent developments in OR / MS research in disaster management operations. *European Journal of Operational Research, 230*(2), 201-211. https://doi.org/10.1016/j.ejor.2013.01.039

Gobbert, K. H., & L. M. Leslie. (2010). Interannual Variability of Northwest Australian Tropical Cyclones. *Journal of Climate, 23*(17), 4538-4555. https://doi.org/10.1175/2010JCLI3362.1

Imamura, F., Muhari, A., Mas, E., Pradono, M. H., Post, J., & Sugimoto, M. (2012). Tsunami disaster mitigation by integrating the comprehensive countermeasures in Padang City, Indonesia. *A Disaster Res, 7*(1), 48-64. https://doi.org/10.20965/jdr.2012.p0048

Kunreuther, H. (2006). Disaster mitigation and insurance: Learning from Katrina. The Annals of the American *Academy of Political and Social Science, 604*(1), 208-227. https://doi.org/10.1177/0002716205285685

Kurniawan, E., Herizal, & Setiawan, B, (2009). The Changes Climate Projection. *Meteorology and Geophisyc Magazine, 5*(2), 139. Monitoring Station Atmosfer Global Sumatra Bukit Kototabang Barat. Available on http://iklim.bmg.go.id/artikel/perubahaniklim.pdf [diakses 15-12-2013].

Masfuah, S., Rusilowati, A., & Sarwi. (2011). Natural Disaster Learning by Swapping Partners With Visionary Model SETS Critical To Grow Student Thinking Ability. *Jurnal Indonesian Physical Education, 7,* 115-120.

Ohgai, A., Gohnai, Y., Ikaruga, S., Murakami, M., & Watanabe, K. (2005). Cellular automata modeling for spreading fire as a tool to aid community-based planning for disaster mitigation. In *Recent Advances in Design and Decision Support Systems in Architecture and Urban Planning* (pp. 193-209). Springer Netherlands.

Oktarina R. (2008). *In the Logistics Information System Mapping for Disaster Management in Indonesia.* http://journal.uii.ac.id/. [Accessed on December 20, 2011].

Peguero, A. A. (2006). The Latino Disaster Vulnerability Mitigation Information Dissemination of Hurricane Among Florida's homeowners. *Hispanic Journal of Behavioral Sciences, 28*(1), 5-22. https://doi.org/10.1177/0739986305284012

Ritchie, B. W. (2009). *Crisis and disaster management for tourism.* Bristol: Channel View Publications.

Rochmad. (2011). *Model of Software Development Mathematics Learning.* Department of Mathematics UNNES.

Rusilowati, A., Supriyadi, Binadja, A., & Mulyani, S. E. S. (2012). Natural Disaster Mitigation Visionary Science-Based Learning Environment Technology and Society. *Indonesian Physical Education Journal, 8,* 51-60.

Smith, K. (2013). *Environmental hazards: assessing and reducing disaster risk.* Routledge.

Yamazaki, F., & Zavala, C. (2013). SATREPS project on enhancement of earthquake and tsunami disaster mitigation technology in Peru. *Journal of Disaster Research, 8*(2), 224-234. https://doi.org/10.20965/jdr.2013.p0224

Yamazaki, F., Zavala, C., Nakai, S., Koshimura, S. I., Saito, T., & Midorikawa, S. (2010). Enhancement of earthquake and tsunami disaster mitigation technology in Peru: A SATREPS project. In *Proceedings of the 7th International Conference on Urban Earthquake Engineering* (pp. 1501-1506).